REMARKS

Status of the Claims

Claims 1 – 21, 31 – 33 are pending. Claims 23 – 30 have been previously cancelled.

Claim rejections - 35 USC § 103

The Applicants have taken due note of the Final Office Action's rejection of pending claims 1-21 and 31-33 for obviousness in view of JEBRAK, ITOH, HITZROT and/or U.S. patent No. 3,625,857 (WEIMER).

With respect, the Applicants disagree and submit the following arguments as to the patentability of the pending claims. First, the Final Office Action has not properly established a *prima facie* case of obviousness. Second, even if a *prima facie* case of obviousness could be established, the claimed invention presents unexpected advantages over the cited references and are thus innovative and non-obvious.

Brief summary of claimed invention:

To briefly summarize the invention as defined in claim 1, the hydrometallurgical process is for treating electric arc furnace dust containing agglomerates of small ferrite particles adsorbed on larger magnetite particles along with various other compounds. The process comprises several steps, namely: (a) washing the dust, (b) decanting the solution to obtain a supernatant liquid and a slurry, (c) separating the slurry and the supernatant liquid, (d) adding to the slurry an anionic surfactant to disperse the ferrite particles adsorbed on the magnetite particles, and (e) treating the slurry to produce various types of pigments.

Final Office Action has not established prima facie *case of obviousness*:

To properly establish a *prima facie* case of obviousness, all factors and findings must be considered as a whole before a conclusion is made. From the factors and findings that will be discussed in detail below, there is no *prima facie* case that the claimed invention would have been obvious to one of ordinary skill in the art.

The cited references cannot be taken alone or in combination to establish a *prima facie* case of obviousness against claim 1 or any of its dependent claims. The principal reason

for the absence of a *prima facie* case of obviousness is that claim 1 comprises step (d) of adding to the slurry an anionic surfactant to disperse the ferrite particles adsorbed on the magnetite particles. None of the references teach or suggest three important aspects of this claimed step:

(i) adding an anionic surfactant as particle dispersant;

(ii) that this addition both desorbs the ferrites from the magnetite and disperses the ferrites relative to each other;

(iii) the order in which the anionic surfactant is added, that is after performing steps (a), (b) and (c).

More particularly, the Office Actions (the first Office Action and the outstanding Final Office Action) have recognized that JEBRAK does not teach using an anionic surfactant on the slurry, and that JEBRAK only suggests using a "deflocculant" or "dispersant" as a means of improving separation of the ferrite and magnetite particles. However, the Office Actions have alleged that it would have been obvious to one of ordinary skill in the art to add an anionic surfactant to the slurry, since anionic surfactants are allegedly well-known to improve the separability of particles. (See in particular page 3 of first Office Action.)

The Office Actions have made several improper assumptions and conclusions in this regard. First, the Office Actions incorrectly conclude that a person skilled in the art would view anionic surfactants as appropriate for separating ferrite particles adsorbed on magnetite particles. In fact, anionic surfactants may be known to improve separability of some materials, but there is no teaching or suggestion in the cited references that anionic surfactants could be used to disperse ferrite particles adsorbed on magnetite particles within a slurry. The Final Office Action cites two references, ITOH and WEIMER, to combine with JEBRAK to support its position. However, these references mention anionic surfactants in such different contexts from JEBRAK that they cannot be used in combination with JEBRAK for establishing a *prima facie* case of obviousness.

More specifically, the Final Office Action states that ITOH teaches that "the addition of sodium metaphosphate to iron oxide particles keeps the particles separated" (paragraph 12). This is incorrect. Nowhere in ITOH is it taught that the sodium metaphosphate "keeps the particles separated". In fact, ITOH merely reports an anomalous increase of coercivity in

iron oxide powder when sodium metaphosphate is dried onto the powder. At best, ITOH suggests sodium metaphosphate as a coercivity increaser for iron oxide powder. However, increasing the coercivity does not equate to dispersing or deflocculating in the context of JEBRAK for two main reasons. First, since ITOH's treatment is on a homogeneous mixture of iron oxide powder, there can be no dispersing of one particle phase from another, such as ferrite particles relative to magnetite particles. Second, since ITOH's iron oxide is in dry powder form and not in solution or slurry form, dispersing or deflocculating is in fact physically and chemically impossible. The single-phase medium to which ITOH adds sodium metaphosphate acquires increased coercivity only. Third, since ITOH applies significant heat of 300°C to dry the iron oxide, the metaphosphate is significantly modified by its heat-accelerated degradation and its crystallization onto the powder. In such a degraded and crystallized state, ITOH's phosphate can in no way be considered a dispersant or deflocculant. In summary, ITOH does not teach that sodium metaphosphate keeps particles separated or disperses or deflocculates particles, and consequently ITOH cannot be combined with JEBRAK to establish a *prima facie* case of obviousness.

The Final Office Action also refers to WEIMER as a reference teaching anionic surfactants used as deflocculants, to support the conclusion that a person skilled in the art would have likely considered an anionic surfactant to use with JEBRAK's process. This conclusion is also incorrect. WEIMER discloses the use of an anionic surfactant as an oil spill dispersant which is a liquid-liquid system usually of hydrocarbons and water. WEIMER's disclosure in no way suggests using an anionic surfactant to disperse ferrite particles adsorbed on magnetite particles within a slurry. The "dispersant" or "deflocculant" suggested by JEBRAK was unequivocally for the distinct purpose of dispersing solid ferrite particles from solid magnetite particles in a liquid medium. The ability for a compound to disperse or deflocculate depends decisively on the material(s) to disperse and the medium in which dispersing occurs. The anionic surfactant of WEIMER is for dispersing liquid-liquid solutions of hydrocarbons and water. Hydrocarbon-water oil spills are strikingly distinct from ferrite-magnetite hydrometallurgical slurries on many levels. For example, the attractive forces between ferrite particles and magnetite particles depend on particle surface charges, magnetic forces, particle size and distribution. WEIMER's hydrocarbon-water systems do not depend on such factors and do not even pertain to dispersing solid particles. For WEIMER, the oil spill dispersant composition "readily penetrates the oil and emulsifies and disperses the oil at substantially infinite water dilution". JEBRAK's deflocculant or dispersant is not meant to

"penetrate" liquid-liquid systems to emulsify two liquids, but is rather suggested to solve a different technical problem. WEIMER clearly teaches away from JEBRAK and the claimed process in this sense. For JEBRAK, a dispersant or deflocculant is specifically limited to dispersing ferrite particles adsorbed on magnetite particles. WEIMER does not teach that anionic surfactants can disperse or deflocculate solid particles, let alone ferrite particles adsorbed on magnetite particles which involves surface charge and magnetic forces, and consequently WEIMER cannot be combined with JEBRAK to establish a *prima facie* case of obviousness.

Furthermore, according to the M.P.E.P., the fact that a claimed species or subgenus is encompassed by a prior art genus is not sufficient by itself to establish a *prima facie* case of obviousness. In the present case, JEBRAK discloses what could be considered a general genus of "dispersant" or "deflocculant" for ferrite and magnetite particles, but this in itself does not render obvious the use of an "anionic surfactant" sub-genus.

JEBRAK defines its dispersant genus by function not structure. JEBRAK's dispersant must be able to disperse ferrite particles from magnetite particles in a liquid medium for improving the separation of those two types of particles. At this point, it is important to discuss what JEBRAK actually suggests by the terms "dispersant" or "deflocculant". These terms are based on the desired result of dispersing specific particles relative to each other in a liquid medium. Dispersing greatly depends on (i) the materials to disperse and (ii) the medium or solvent in which dispersing occurs. In fact, a good dispersant for a particular material and solvent may be an ineffective dispersant in another context. It is crucial to consider context to determine the teaching of the prior art. Taken out of context, the general term "dispersant" has been used in ancient Roman trades to refer to animal fat, milk and blood which were used for dispersing concrete mixes. In this regard, neither ITOH nor WEIMER teach dispersants or deflocculants in the context of JEBRAK. More specifically, ITOH teaches a single material in a single phase, in absence of any solvent or medium for dispersing to occur, and thus there can be no dispersing or deflocculating. WEIMER teaches materials to disperse that are in a different phase, i.e. liquid not solid, the oil and water are dispersed into each other rather than away from each other as required with the ferrite and magnetite particles, and the types of agglomeration forces to overcome are starkly different from JEBRAK. WEIMER and ITOH are so different from each other and from JEBRAK that a person skilled in the art would have had no motivation to combine these references.

It is also important to consider the express teachings of the cited references and give such express teachings their due weight (See M.P.E.P. 2144 for example). JEBRAK expressly teaches only methanol as a species of the dispersant genus. As argued previously, methanol is very different from anionic surfactants and in fact teaches away from the anionic surfactant sub-genus. JEBRAK also expressly teaches that they do not know what structure, nature or quality of chemical agent would be appropriate as a dispersant, and that further innovation and research is needed. Furthermore, ITOH expressly teaches sodium metaphosphate as a coercivity increaser for dry iron oxide powder only, not as a dispersant or deflocculant, and thus does not disclose or suggest a dispersant at all. Finally, WEIMER discloses an oil spill dispersant for hydrocarbon-water liquid solutions, not a dispersant for solid ferrite particles adsorbed on magnetite particles within a slurry. The express teachings of the cited references are disparate, teach away from each other and the claimed invention, and thus weigh heavily against combining them.

It is also important to consider the predictability of the technology (See M.P.E.P. 2144 for example). The treatment of electric arc furnace dust using hydrometallurgical processing is a field of technology dealing with highly complex multi-component multiphase particulate mixtures and process steps based on particle surface properties, complex chemical interactions, solution chemistry, and electromagnetic chemistry. The effects of adding compounds into such complex chemical mixtures have a high degree of unpredictability. One fact supporting this position is that some of the authors of the JEBRAK reference are also inventors of the present claimed invention. These researchers are experts in this field and when writing the JEBRAK article clearly did not know what dispersant or deflocculant would be appropriate to use or how to go about discovering it. The complex nature of electric arc furnace dust and its processing makes this field intricate and unique, and it would be improper to import teachings from non-analogous or dissimilar arts.

It is also important to consider the teachings of structural similarity or dissimilarity (See M.P.E.P. 2144 for example). JEBRAK teaches only methanol as a dispersant, which is structurally dissimilar to anionic surfactants. JEBRAK's teachings of the preferred methanol species within the general dispersant/deflocculant genus would motivate a person of ordinary skill to use similar species to methanol, such as other alcohols or perhaps carboxylic acids or other similar compounds, and thus JEBRAK teaches away from using anionic surfactants.

It is also important to consider the teachings of similar or dissimilar properties or uses

(See M.P.E.P. 2144 for example). ITOH and WEIMER describe anionic surfactants in applications that are drastically different from the suggested use of JEBRAK's dispersant or deflocculant. In fact, neither ITOH nor WEIMER describe or suggest dispersants/deflocculants in JEBRAK's context and meaning of such terms.

Finally, not only do JEBRAK, ITOH and WEIMER not teach adding an anionic surfactant as dispersant to disperse ferrite particles adsorbed on magnetite particles, but they also give no teaching as to the claimed order of step (d) within claim 1. JEBRAK merely states that a dispersant can be added to improve separation of the ferrite and magnetite particles. However, claim 1 specifies that there must be the previous steps (a), (b) and (c), which notably allow the removal of dissolved salts, metals and simple oxides, before adding the anionic surfactant to the slurry. This claimed addition point is not taught by the cited references. Consequently, since all elements of a claim must be found somewhere in the prior art, the cited references cannot be combined to establish a *prima facie* case of obviousness.

In summary, the above factors and findings, considered as a whole, show that there is no *prima facie* case of obviousness of the claimed invention. A person skilled in the art would not have been taught, suggested or motivated to combine the cited references to arrive at the claimed invention.

Arguments that claims are non-obviousness:

Despite the above arguments refuting a *prima facie* case of obviousness, the Applicants nevertheless submit further arguments that the claims are non-obvious and patentable over the cited references.

Claim 1 includes the step (d) of adding to the slurry an anionic surfactant to disperse the ferrite particles adsorbed on the magnetite particles. This step renders the claim non-obvious over the cited references for two main reasons:

(i) Adding an anionic surfactant as dispersant presents advantages over other types of dispersants by:

- decreasing cohesion between the ferrite and magnetite particles causing desorption of the ferrite from the magnetite particles, and

- reducing the positive charge of the ferrite particles to increase the repulsion between the ferrite particles within the slurry thus improving the dispersing effect the ferrites relative to each other in the slurry.

(ii) Adding an anionic surfactant occurs at an advantageous entry point within the claimed process, after performing claim 1 steps (a), (b) and (c), which improves the dispersing effect of step (d).

See paragraphs [0009] - [0012], [0157] and [0158] of the present published application No. U.S. 2007/0214912 in this regard.

More particularly regarding point (i), it was found that using an anionic surfactant as dispersant presents unexpected advantages over other compounds by acting according to the charge of the ferrite particles. The anionic surfactant allows advantageous effects by both decreasing cohesion between the ferrite and magnetite particles and also reducing the positive charge of the ferrite particles to increase the repulsion between the ferrite particles themselves. This dual functionality is synergistic and is enabled by the charge properties of the ferrites and magnetites in combination with the anionic surfactant. This dual functioning would not be enabled by just any and all dispersants. Consequently, since the anionic surfactants have an unexpected effect of advantageously dispersing the ferrite particles adsorbed on the magnetite particles, claim 1 is non-obvious over the cited references.

Regarding point (ii), adding the anionic surfactant to the slurry after performing steps (a), (b) and (c) also presents unexpected advantages over adding it randomly or at other entry points in the process. For instance, if the anionic surfactant is added before dissolution and removal of the soluble salts in steps (b) and (c), then the dispersing effect of the anionic surfactant is significantly diminished. The entry point of the anionic surfactant is not a trivial matter and was discovered through extensive experimentation. JEBRAK does not disclose or suggest this entry point, nor do any of the other cited references. The cited references do not suggest the claimed order of the process and this order presents unexpected advantages. Consequently, the claims are non-obvious over the cited references.

It is important to consider the claimed invention as a whole. The ordered process steps and the addition of an anionic surfactant as defined in combination with all other elements of claim 1 allow an advance in the art that is non-obvious.

It is also important to note that the dependent claims provide additional features that

should be considered individually in terms of patentability.

For instance, when the anionic surfactant is a phosphate, as defined in claim 5, the phosphate provides the further advantage of sequestering calcium compounds within the slurry to allow for improved treatment of the resulting slurry, for instance when performing screening or magnetic separation. Indeed, the calcium compounds in the slurry presented a technical problem for obtaining pigments, and the phosphate enables an innovative solution by sequestering the calcium compounds, desorbing the ferrite particles from the magnetite particles and dispersing the ferrite particles in the slurry. Thus, the phosphate enables a triple functionality that is not taught or suggested by the cited references. This advantageous functionality further renders claim 5 non-obvious over the cited references.

In addition, when the anionic surfactant is sodium metaphosphate, as defined in claim 6, the sodium metaphosphate provides further advantages. Sodium metaphosphate allows improved conversion of calcium and calcium hydroxides present in the slurry into a calcium phosphate which is precipitated as a solid. This form of calcium sequestering allows various downstream treatments of the slurry, such as quicker and sharper fractionation of the slurry by, for example, a drum magnet, separation by screening as clogging of the mesh openings is minimized. The cited references make no mention of such advantageous functionality of adding sodium metaphosphate to a hydrometallurgical slurry, and this advantageous functionality further renders claim 6 non-obvious over the cited references.

In view of the above, the rejections to various dependent claims in view of JEBRAK, ITOH, HITZROT and/or WEIMER are either overcome or moot.

Conclusion:

In light of the above, the rejections of claim 1 and its dependent claims 2-21 and 31-33 should be withdrawn and an indication of allowance should be emitted. Applicants would like to thank the Examiner for his/her time and consideration of this case. If a telephone conversation would help clarify any issues, or help expedite prosecution of, this case, Applicants invite the Examiner to contact the undersigned at (617) 248-5222. Additionally, please charge any fees that may be required or credit any overpayment to our Deposit Account 03-1721.

Respectfully Submitted,
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